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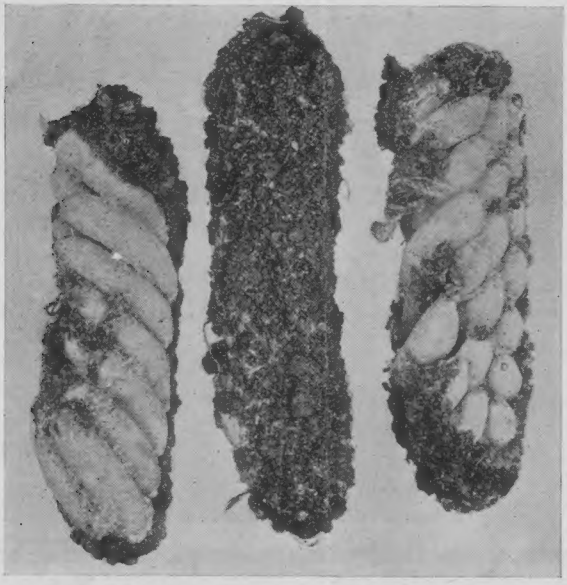
EXTENSION BULLETIN NO. 98

Grasshopper Control



GRASSHOPPER EGG CLUSTERS
Magnified approximately five diameters.

By

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Published by Authority of Hon. A. Prefontaine, Minister of Agriculture and Immigration.

GRASSHOPPER CONTROL

COMMON SPECIES OF GRASSHOPPERS

In Manitoba several species of grasshoppers are of economic importance. The most injurious species is the clear-winged grasshopper, *Camnula pellucida* Scudd., which masses its egg clusters, largely during the month of August, in the short-grassed areas along lanes, fences, headlands, roadsides, etc., that frequently border grain fields. These egg clusters, which are shown on the front cover of this bulletin, are to be found mostly in the top inch of the soil. Other common injurious species are the two-striped grasshopper, *Melanoplus bivittatus* Say, the lesser migratory grasshopper, *Melanoplus mexicanus* Saussure, the red-legged grasshopper, *Melanoplus femur-rubrum* De G., and Dawson's grasshopper, *Melanoplus dawsoni* Scudd. These species scatter their egg clusters throughout fields, etc.

All of our injurious species of grasshoppers pass the winter in the egg stage and in each case there is only one brood each year.

There are many other species of grasshoppers in Manitoba, most of which are of little economic importance.

The identity of the grasshoppers in a locality is of considerable in-

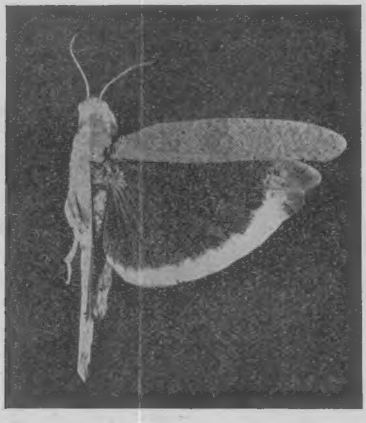

FIG. I—THE CAROLINA GRASSHOPPER IS A CONSPICUOUS SPECIES, BUT IT IS NOT DESTRUCTIVE TO FIELD CROPS. (PHOTOGRAPH BY W. A. CUMMING).

terest and importance to most farmers. Frequently, for example, the Carolina grasshopper, *Dissosteira carolina* (L.), which has black centred hind wings bordered outwardly with yellow, arouses much concern. This grasshopper, however, is of relatively little economic importance.

Farmers and others who desire to know the names of the local species, and whether or not they are injurious, should submit numbered specimens, which they have collected, to the Department of Entomology, Manitoba Agricultural College, Winnipeg, or to the Dominion Entomological Laboratory, Treesbank, Manitoba, for identification.

THE CONTROL OF GRASSHOPPERS

EARLY SPRING CONTROL

BURY THE EGGS—Examine short-grassed areas along roadsides, fences, lanes, headlands, etc., for egg beds, especially if grasshoppers were plentiful on the farm the previous season. If egg pods are found, the infested area should be plowed before any of the eggs hatch. Small areas of this character hold millions of eggs, which will hatch later and infest

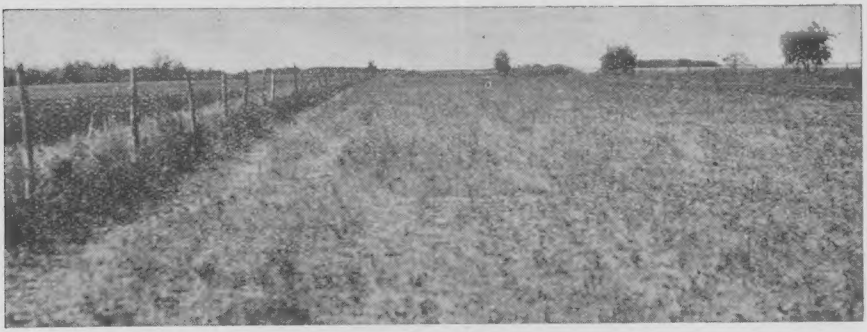

FIG. II—THIS IS A TYPICAL SHORT-GRASSED AREA ON A ROADSIDE BORDERING A FIELD PREPARED FOR WHEAT. THIS SOIL CONTAINS AN IMMENSE NUMBER OF EGG CLUSTERS OF THE CLEAR-WINGED GRASSHOPPER.

whole fields. Plow these areas six inches deep, turning the furrow upside down. Use a skimmer on the plow, so that all the sod will be buried six inches deep. If possible, pack this land, so that the young hoppers cannot get up through any cracks to the surface. An examination should be made, also, of stubble lands which were not fall plowed, to see if egg pods are present. If only a few egg pods are found per square yard, there are enough potential grasshoppers there to infest the whole field. Such fields should be plowed six inches deep and the furrow turned upside down and not on edge. Use a skimmer on the plow so that all eggs shall be buried.

EXPOSE THE EGGS—Discing infested soil exposes grasshopper eggs to the drying effects of winds, and is considered a useful control measure.

LATE SPRING AND SUMMER CONTROL

BURN STRAW—If short-grassed areas, such as mentioned above, have not been plowed, and if the young grasshoppers have emerged already in great numbers, good control work may be accomplished by covering such areas with straw and burning it. These grasshoppers return to their hatching grounds to roost each night for a short time after they hatch. The straw should be burned some cool evening after they have taken shelter in it. Sometimes patches of dry weeds covering ground where young hoppers have emerged may be burned, with a great destruction of young hoppers.

USE POISONED BAITS—Once the grasshoppers have hatched, certainly the best way to kill them is by means of poisoned baits. Since our injurious grasshoppers can fly, any local outbreak is the affair not only of the farmers directly concerned, but also of the whole community. The infestation of one year may move to another locality the next year. It may pay the farmers exceedingly well in an immune area to assist in controlling an outbreak, as the infestation may shift their way next year, if not controlled. Townsmen are interested in the crops around the town, and in most cases are willing to help poison grasshoppers.

MANITOBA POISONED BAIT

Bran	50 lbs.
Sawdust	Bulk equal to Bran.
White arsenic or paris green	5 lbs.
Salt	2 to 5 lbs.
Water	10 to 12 gallons.

NOTE 1—One quart of liquid sodium arsenite containing two pounds of As_2O_3 may be used in the above formula in place of the white arsenic or paris green.

NOTE 2—100 lbs. of bran may be used in the above poisoned bait if sawdust cannot be obtained.

NEW POISONED BAIT FORMULA

Finely cut green fall rye or wheat plants	100 lbs.
White arsenic or paris green	5 lbs.
Common salt	2 to 5 lbs.
Water	Sufficient to moisten.

NOTE 1—Lawn clippings were used successfully as the carrier for the poison on golf courses at Winnipeg in 1931.

During the summer of 1922 comparative tests were made of a number of baits at Manitoba Agricultural College. Baits containing finely cut green wheat plants as a carrier for the poison proved more attractive to the grasshoppers than those containing bran and sawdust. Field experiments were undertaken during the summer of 1923 with excellent killing results. The idea underlying the use of green fall rye or wheat plants was to get a carrier for poisons which does not cost the farmer actual cash, as bran does. The rye or wheat plants are produced on the farm, and, although it takes time to run the plants through a cutting box, there is no actual money outlay connected with that part of the bait. Fall rye comes on early in the spring, and by the time baits are needed to control grasshoppers, rye plants are a good size. From the fall rye field cut the needed amount of green plants and run them through a cutting box, cutting the plants as fine as possible; the finer the pieces are, the better. Later in the season, when the rye is too far advanced, wheat plants may be prepared in the same manner. The plants, being green and moist, retain their freshness and palatability longer than bran, which is known to dry out relatively fast after being scattered on the ground.

CENTRAL STATION FOR MIXING POISONED BAITS—Where the outbreak of grasshoppers is at all extensive in a community, and where a number of farmers are using the bait, it is important that the mixing be done at some central mixing station. This system saves a great deal of time to the farmer, and also enables him to secure uniformly well mixed baits, which are absolutely essential for successful grasshopper control. A mixing station should be located in the centre of an infested area, if possible, so that it will be equally accessible to all who need the ready-mixed baits.

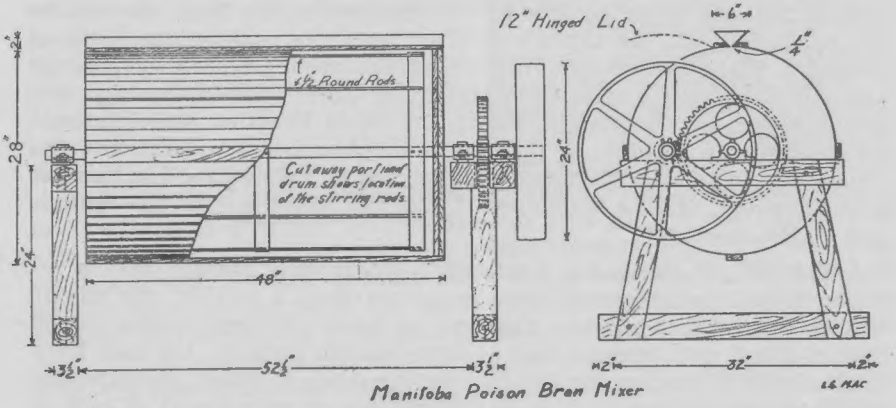

FIG. III—TWO VIEWS OF THE MANITOBA MIXING MACHINE

THE MIXING MACHINE—During the last outbreak a home made mixing machine was devised in Manitoba which had a capacity of several tons of poisoned bait daily. One important feature of this machine is that it can be made in any town from parts of worn-out machinery and at very small cost.

The following materials are needed:—

(1) Several pieces of timber 4 in. by 4 in.
(2) The fan shaft from an old threshing machine.
(3) Old mower gears.
(4) A drive wheel.
(5) New sheets of galvanized iron.
(6) Miscellaneous lumber, strips of wood, iron rods, etc.

The frame of the machine may be made either of wood or iron. The ends of the drum are made of two ply of inch boards, while the remainder of the drum is made of new sheets of galvanized iron. The arms attached to the fan shaft of the old threshing machine are used to hold stirring rods which run from end to end. Two half-inch rods are run through each arm along the length of the fan shaft. In all, there are eight of these rods extending the length of the inside of the drum. On the top of the drum a hinged lid extends along its whole length, through which the dry ingredients are dumped into the machine. Just above this there is arranged a trough through which the water is poured after the

dry materials have been thoroughly mixed. Men who do the mixing find this trough very useful, since when the lid is opened upon the dry mixture the fine particles of the poison fly out into the air with injurious effects upon those who are forced to be continually in the room. A drive wheel is selected which will turn the shaft at about 15 revolutions per minute. A gasoline engine supplying two or three horse power is usually satisfactory.

When the machine is in operation, the drum is fastened with a hasp or bar to the framework, yet is so arranged that it may be unfastened when the mixer is stopped. The drum may then be given a half revolution, so that the whole mixture may be dumped on the floor. As soon as the mixture is out, the drum is revolved back into position and fastened securely. When the machine is running, the mixing rods revolve slowly and stir the mixture within the stationary drum. When the dry materials have been thoroughly stirred, the liquid is added while the machine continues its work, so that no time is lost in this operation. The whole machine should be placed on the edge of an elevated platform, so that when the mixture is dumped it falls out of the way of the workers and of the machine.

MIXING IN SMALLER AMOUNTS—Where only enough bait is required to poison the grasshoppers on one farm in a locality, the mixing may be done with a shovel. The bran or finely cut green plants should be spread out on a cement floor or other smooth surface. On each hundred pounds of the carrier the required amounts of poison and common salt should be sprinkled. It is best to sprinkle on only a part of each of these at a time during the operation of stirring, as it is very necessary to have every individual piece of the carrier covered with the poison. Only those particles to which the poison adheres have any killing value. After mixing well, water should be added gradually during the stirring process until, when a handful is squeezed, the liquid oozes from between the fingers but does not drip from the hand. If liquid sodium arsenite is used, the proper amount should be diluted in the required amount of water, in which the salt has been dissolved, and added gradually to the carrier during mixing. The whole pile should be shovelled over and over again and then put in bags ready for the field. The floor should be cleaned thoroughly and the bags destroyed after the bait has been used. Animals have been killed through carelessness. Mixed baits may be held in bags for several days before being scattered, so long as the bait is still moist. Some farmers claim that baits so held are better than freshly mixed baits.

WHEN, WHERE AND HOW TO SCATTER THE BAITS—To get the best results, it is most important to scatter the poisoned bait at the proper time. Parker* states that the clear-winged grasshopper under Minnesota conditions "feeds sparingly at bran mash baits at air temperatures of 62 degrees to 66 degrees F., more actively at air temperatures of 67 degrees to 70 degrees F., and most actively at air temperatures of 71 degrees

* J. R. Parker. Some Effects of Temperature and Moisture upon *Melanoplus mexicanus* Saussure and *Camnula pellucida* Scudder (Orthoptera). Bulletin No. 223, January 1930, University of Montana, Agr. Expt. Station, Bozeman, Montana.

to 77 degrees F. On days when hourly mean temperatures are below this range, the time of heaviest feeding occurs during the hour when the highest temperature for the day is first reached. Feeding decreases very rapidly at air temperatures above 80 degrees F." He also states that "a study of weather records shows that the general hatching of both *Melanoplus mexicanus* and *Camnula pellucida* eggs takes place during the first warm period of from 3 to 5 days having maximum temperatures above approximately 75.2 degrees F." In the Department of Entomology, Manitoba Agricultural College, Winnipeg, thermograph records were taken for the summers of 1930 and 1931. Based on the above, hatching in 1930 was general in this vicinity during the last two days of May and the first three days of June. In 1931 hatching may have occurred a few days earlier, but probably was general at about the same dates. Hatching may have occurred earlier in some other localities. During the month of June, 1930, the optimum range of temperatures for feeding was reached on twenty days and in 1931 on twenty-one days. In 1930 the temperature 71 degrees F. was first reached at 8:00 a.m. on one day, at 9:00 a.m. on six days, at 10:00 a.m. on three days, at 11:00 a.m. on four days, at noon on two days, at 1:00 p.m. on two days, at 2:00 p.m. on one day and at 3:00 p.m. on one day. In 1931 the temperature 71 degrees F. was first reached before 8:00 a.m. on three days, at 8:00 a.m. on two days, at 9:00 a.m. on four days, at 10:00 a.m. on one day, at 11:00 a.m. on three days, at noon on five days, at 1:00 p.m. on one day and at 2:00 p.m. on two days. All of the above are estimated to the nearest hour. It can be seen from the above data that the hour at which maximum feeding begins varies greatly. On most days it was before noon and frequently by the middle of the forenoon. Grasshoppers will not feed during a rainy, dull or cool day, and, therefore, mixed baits should be held until favorable weather prevails. Government weather forecasts are very useful for

FIG. IV—BROADCASTING THE POISONED BAIT. NOTE THAT THE ROWS OF GRAIN HAVE BEEN EATEN OFF ALONG THE EDGE OF THE FIELD. THE GRASSHOPPERS WHICH HAVE EATEN THE POISONED BAIT DIE IN ABOUT TWO DAYS' TIME.

indicating expected weather conditions. Baits should be scattered during a morning that promises to be followed by a sunny, warm, calm day. Baits should be scattered or broadcast just as grass seed is broadcast on the land. A handful of bait should be scattered thinly with the fingers and thumb. Actual killing results are better where the bait is scattered very thinly. Under no circumstances place the bait out in piles or rows along the edge of the field. Such bait will be wasted. The bait should be scattered in strips along the edge of the field where the grasshoppers are actually feeding and again in a strip a little ahead of where they are active. In fields where they are scattered throughout the whole crop, the bait should be scattered lightly in strips over the whole field. The tendency is to spread too much on the ground rather than too little. Results of the poisoned bait may be seen in twenty-four hours, but maximum results should not be expected inside of forty-eight hours. Care should be taken not to mistake cast-off skins from the molting young for dead grasshoppers. It is highly desirable to poison grasshoppers as soon as possible after they hatch.

CONTROL ON LAND TO BE SUMMERFALLOWED—When farmers are plowing late summerfallows, frequently great numbers of grasshoppers are found on this land. Until these grasshoppers reach maturity and develop wings they feed upon the vegetation at hand. As soon as they grow wings they usually move out into the crops. It is, therefore, important to kill them while they are still on the land to be summerfallowed. Actual experience has shown that they may be controlled with comparative ease on such land. Farmers have found that by plowing this land in strips and leaving unplowed lands about twenty feet wide, the grasshoppers will gather on these unplowed areas. This is true only before the grasshoppers develop their wings. These strips of unplowed land where the grasshoppers have gathered in millions should be treated with the poisoned bait. On these areas, if the grasshoppers are exceptionally thick, the bait should be used more liberally than usual. Excellent results have been obtained from scattering bait on these areas. One should remember that it is important to poison these grasshoppers on land to be summerfallowed, because they move to fields of grain as soon as there is nothing more for them to eat in their old haunts.

AUTUMN CONTROL

Autumn control is the same as that of early spring. Plow the eggs under to a depth of six inches, turning the furrow slice upside down. If the furrow slice is turned on its edge, some of the eggs will be almost at the surface of the ground, and will be sure to produce grasshoppers. Use a skimmer on the plow. This attachment throws the upper inside part of the furrow slice, with all its eggs, in the bottom of the furrow.

MISCELLANEOUS INFORMATION

NOTES ON THE POISONS USED IN THE BAITS

Some form of arsenic is used usually as a poison in grasshopper baits. The cheapest effective and convenient form is the one to select. Any one of three forms, namely, white arsenic, sodium arsenite, or paris green, will kill grasshoppers readily. White arsenic is a cheap form of poison, but as it is a fine powder, it gets into the air in buildings used for mixing stations during the mixing process, and is inhaled by the workers. It is not very soluble in water, and therefore must be mixed thoroughly with the carrier in a dry state. Liquid sodium arsenite is used in solution, and does not get into the air in mixing stations. As it is in solution, it acts quickly upon the digestive system of the grasshopper. Every particle wet by the solution is poisoned. Paris green is expensive, is relatively insoluble in water, and flies about the mixing station when the dry ingredients are being mixed. It is useful in an emergency until a cheaper form can be secured. Sodium fluoride proved to be effective as a poison for grasshoppers in experiments conducted at Manitoba Agricultural College, Winnipeg, during 1931.

NATURAL CONTROL

Natural control operates over a period of several years. When young grasshoppers are emerging, artificial methods of control should be put into operation immediately. Over a period of years, however, a number of natural enemies of grasshoppers have appeared in certain localities and have assisted the farmers in keeping the grasshoppers under con-

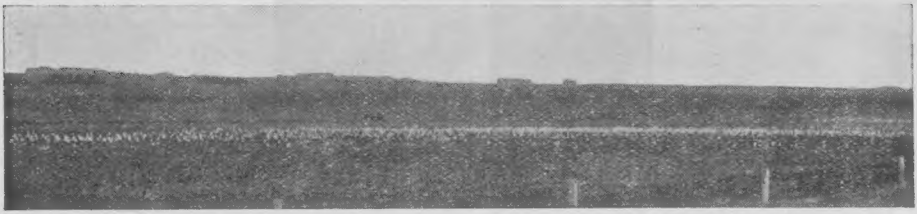

FIG. V—FRANKLIN'S GULL IS FEEDING ON GRASSHOPPERS IN THIS FIELD.

trol. Of the birds, Franklin's Gull, which breeds in great numbers around some of our small Manitoba lakes, and which appears on the cultivated land in flocks of thousands, is probably the most useful. The farmer with grasshoppers is very fortunate to have a visit from a great flock of these birds. They devour countless numbers of grasshoppers and at times clean up badly infested fields. Turkeys are fond of grasshoppers, and will range far from the buildings in search of this favorite food. Hens also will eat grasshoppers, but will not eat so many of them as will turkeys. Our grouse, no doubt, assist a great deal in keeping down insect outbreaks of all kinds, especially grasshoppers. The common English sparrow has been seen with a grasshopper in its bill.

Among the insect enemies of grasshoppers the bee-fly is important. These insects are enemies of the eggs. Their young are commonly found

in the egg pods in the spring. The red mite also attacks the egg clusters as well as the adult grasshoppers. The body and wings of the adult grasshopper sometimes harbor a score or more of these parasites. They do no serious harm to the adults, however, except probably to make them uncomfortable. Sometimes the wings of old grasshoppers are badly frayed, due to repeated attempts to get rid of the tenacious red mites.

SPECIAL INSTRUCTIONS TO MEN IN CHARGE AT MIXING STATIONS

1. The poisons used in the baits are deadly, and should be used with extreme care. Care should be taken to prevent the fine dust-like particles of the poison from flying about the mixing station. Paris green is worse than white arsenic in this respect. A respirator worn over the nose will prevent the fine particles from being inhaled. Care should be taken to keep the hands free from cuts and open wounds.

2. All farmers who come to the station for mixed baits should be

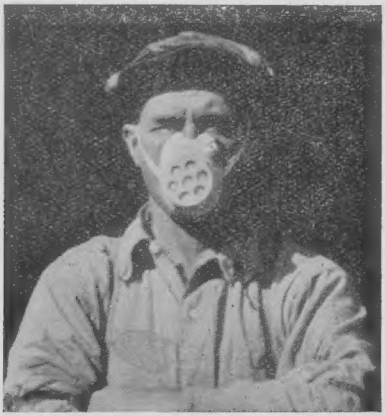

FIG. VI—A RESPIRATOR PROTECTS THE MIXING STATION OPERATOR FROM INHALING THE PARTICLES OF POISON. WHERE DRY POISONS ARE USED, OPERATORS SHOULD ALL WEAR RESPIRATORS.

warned of the extremely poisonous nature of the material, and that the bags of bait should not be left where animals can get at them. The salt in the bait makes it attractive to animals where they can get at it in bulk. When it is thinly scattered on the ground there is no danger of animals getting it in harmful amounts.

3. Measure or weigh out accurate amounts of all the ingredients. Much material will be wasted by carelessness in this matter.

4. Remember that thorough mixing is absolutely essential for successful control. Every particle of the carrier should be covered with the poison. Only those pieces of the bait with poison on them have any killing value.

5. Explain to each farmer when and how to scatter the bait. The method of doing this is explained elsewhere in this bulletin.

6. Emphasize the fact that baits should be kept until favorable weather conditions prevail for successful poisoning. Much money can be saved by putting out the baits only during favorable weather conditions. Baits will not deteriorate if kept in a bag for a few days.

"DON'TS"

1. Under Manitoba conditions of farming we do not advise the use of the hopper-dozer. This is a home-made machine which is dragged over the infested field. It is so constructed that by the use of coal oil and water the grasshoppers are caught and killed by coming into contact with the oil. The poisoned baits produce many times better results with only a fraction of the labor.

2. The hopper catcher is a machine so constructed that it will catch the grasshoppers alive. This also is a machine not at all adapted to our conditions.

3. Attempts to burn the grasshoppers with special burning machines when the grasshoppers were very numerous in any one place also proved unsuccessful. All devices constructed upon this principle have been discarded in favor of poisoned baits.

4. In areas where the young grasshoppers were swarming over the ground, an attempt was made to spray them with oil. This proved very slow and was considered a failure.

LEGISLATION IN MANITOBA RELATING TO INSECTS

An Act to Amend the Municipal Act, 1920:—

600A. The council of a municipality may, by resolution supported by two-thirds of its members, institute measures for the destruction and control of grasshoppers or other insect pests injurious to crops, and may vote out of the general revenue of the municipality such sum or sums as may be required for the purpose.

IDENTIFICATION OF INJURIOUS INSECTS

All unknown insects which are injurious to field crops, vegetables, flowers, shade and fruit trees, animals and to the household in any way, should be sent to the Department of Entomology, Manitoba Agricultural College, Winnipeg, for identification. The postage is one cent per ounce on packages of this sort. Place the specimens in a cardboard box along with some of their food, if possible, and wrap securely. Be certain to place your name and address on the package. We shall identify the specimens and suggest practical methods of control.

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EXTENSION BULLETIN

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CIRCULARS

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First Lessons in Sewing.
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MISCELLANEOUS

Noxious Weeds Act (Manitoba).
Manitoba Annual Crop Report.